Modelling Air Pollution Dispersion from a Natural Gas Facility in Bonny, Nigeria

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Aims of the Research

Improve on an air quality model capable of
✓ predicting pollutant ground level concentrations, first for existing oil and gas industries and secondly serving as an integral part of EIA for upcoming facilities.

Model air pollution dispersion of a liquefied gas facility
✓ in assessing compliance to National air quality standards.

Determine the contribution of facility emission to total emission
✓ for assessing the facility's seasonal contribution

Figure 1: Gas flaring in the Niger Delta

There is a significant relationship between gas flaring and
✓ Poor yield
✓ Premature fruiting
✓ Colour changes in leaves,
✓ Low fish catch,
✓ Migration of fishermen,
✓ General behavioural change in the area,
✓ Acid rain (Udia, 2005; Sonibare and Ede, 2009)

Figure 2: showing effects of atmospheric stability on dispersion

Modelling Air Pollution Dispersion

Physical models (wind Tunnels, tank experiment)

Mathematical model

❖ **Simulation (deterministic): based on mathematical description of physical and chemical processes taking place in the atmosphere**

❖ **Empirical (Statistical): monitoring past air quality data.**

Generally, mathematical modelling is about solving;
❖ Continuity equation
❖ Energy equation
❖ Motion equation
❖ Water transport equation
❖ Pollutants transport equation

But can be **Lagrangian, Eulerian** or **Gaussian**

Features
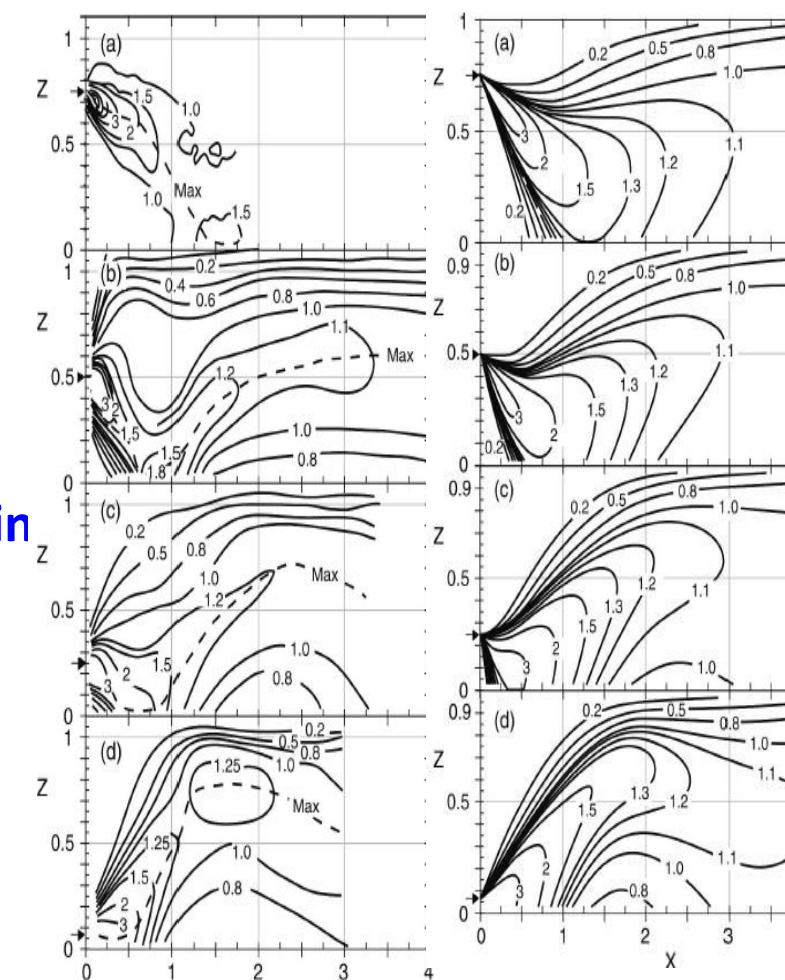
❖ Was first introduced 1995 (Stull, 1995, 2000)

❖ To approximate the time – averaged, zeroth order effects of **point source conservative**, pollutants dispersion in convective ABL

❖ In family of **New generation Gaussian plume** model; it uses

Limitations

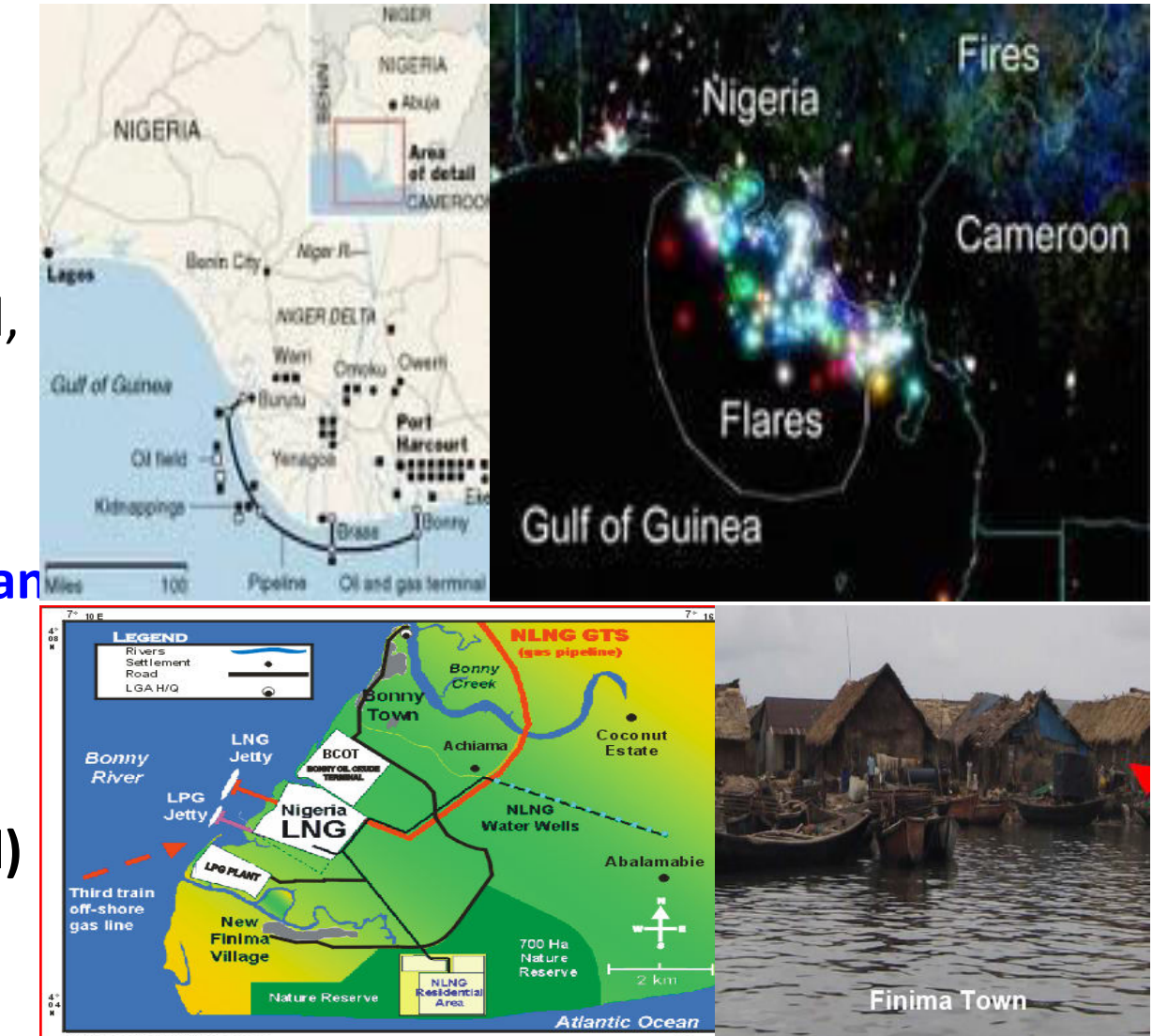❖ **Cannot simulate horizontal (lateral) plume spread, but it can be modified to do so.**

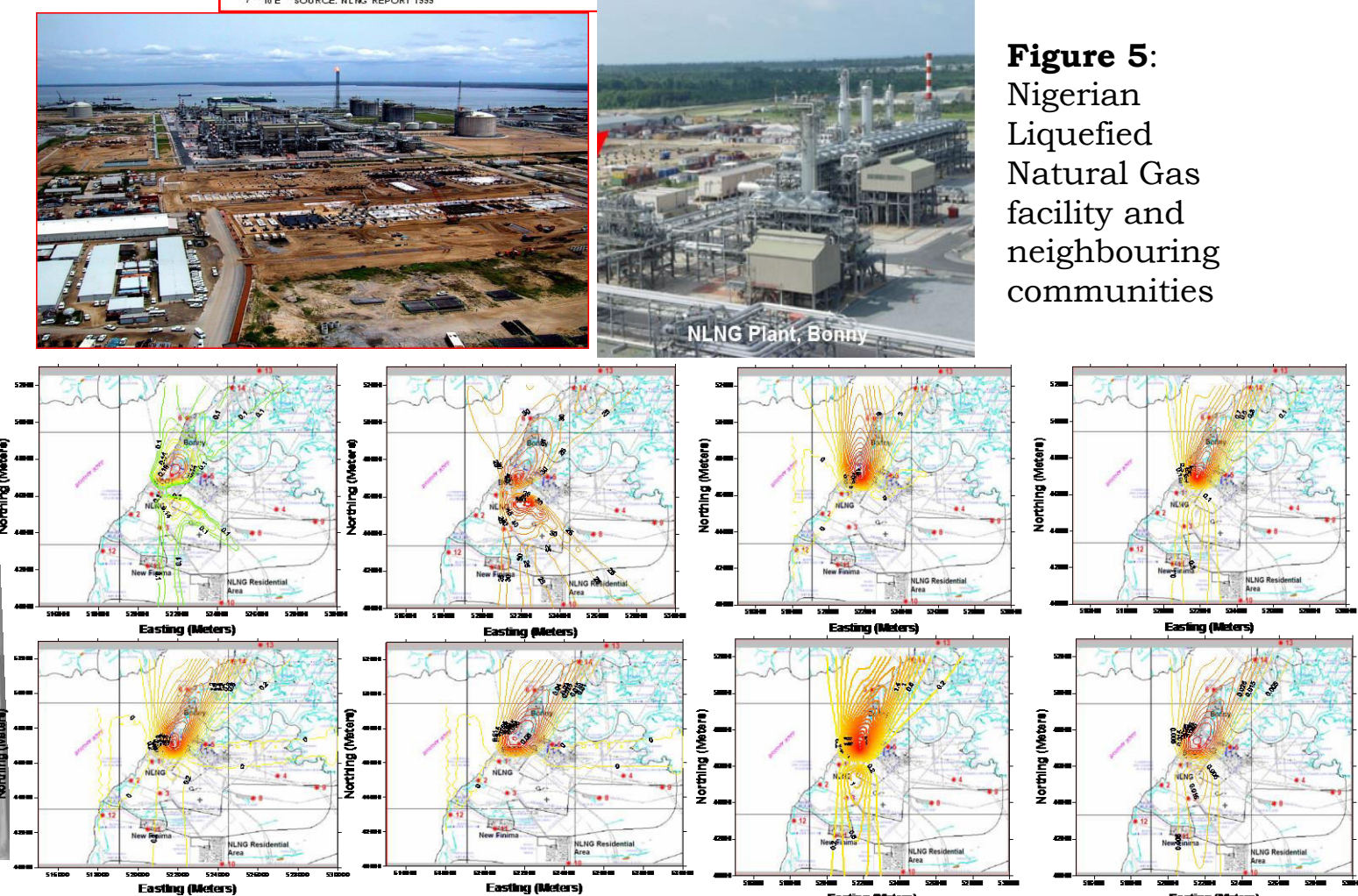**Figure 3**: result of comparing SCDM with others

Figure 4: pollutant horizontal dispersion using UK ADMS

Figure 5: Nigerian Liquefied Natural Gas facility and neighbouring communities